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A METHOD FOR THE IMPROVEMENT OF BUTTERMILK FROM PASTEURIZED CREAM

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At the present time there is a general demand for pasteurized dairy products, showing that the public appreciates clean, safe food. The pasteurization of cream for butter-making is becoming more general, and while this process enables the buttermaker to produce uniform butter it has a subsequent detrimental effect upon the buttermilk.

The buttermilk from pasteurized cream is thin and watery, usually lacking in flavor, and wheys off very readily; it may also lack the desired buttermilk acidity which the trade demands. Because of these defects, many creameries are losing the opportunity to supply the current demand for good buttermilk. Some creamery operators insist that the loss due to the decreased demand for buttermilk from pasteurized cream is equal to 2 cents per pound on the butter. The economical disposal of the by-product of the creamery is more important than the development of creamery side lines.

The method described in this circular for improving buttermilk from pasteurized cream has been tried at the University of Illinois Creamery and has proved to be very successful. It consists in adding to the pasteurized buttermilk about 10 percent of a starter prepared from a culture sold under the commercial name of Bacillus Bulgaricus. When properly made, this preparation both furnishes a pleasant acid and changes the thin pasteurized buttermilk into a heavy-bodied product with all the pleasing characteristics of raw buttermilk.

In ordering the commercial culture of Bacillus Bulgaricus, the purpose for which it is to be used should be specified and the culture which makes the milk viscous should be requested.

Since this product is made from nine parts of buttermilk and one part of skim milk, it should not be sold under the name "buttermilk" unless the other ingredients are also named on the label.[1] It differs from the ordinary commercial buttermilk, which is made by ripening two equal amounts of skim milk, one with a commercial butter culture and the other with a commercial culture of Bacillus Bulgaricus, and churning the two lots together.

This preparation of pasteurized buttermilk will be of interest to many creameries where the manufacture of the ordinary commercial buttermilk is impossible.

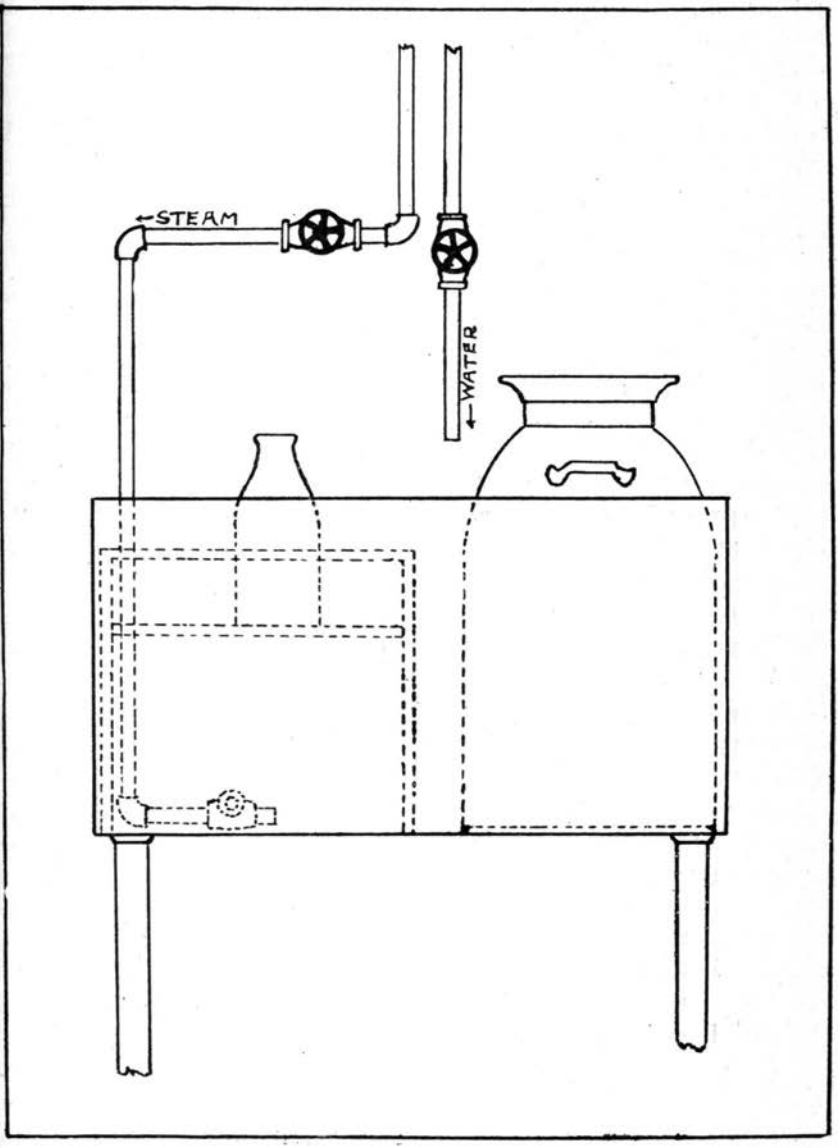
Apparatus

The Bacillus Bulgaricus culture develops best at temperatures between 95° and 100° F. This is 20° to 30° above the best temperature for the growth of the cream-ripening cultures. It has been found convenient to hold the quart bottles or eight-gallon cans in which the cultures are being developed in a wash sink 30 x 20 x 16 inches deep. By means of water and steam connections, the sink is kept full of water at a temperature between 95° and 100° F., thus serving the purpose of an incubator. The quart bottles are supported by a rack so that they are immersed within three inches of the top.

With this arrangement it is necessary to warm the water by the admission of steam about every six hours in order that the temperature may be maintained between 95° and 100° F. Besides the bottle rack, this sink holds an eight-gallon can for the bulk culture.

The sink and bottle rack are also used for pasteurizing milk in bottles for culture propogation.

[1] Ruling of Board of Food and Drug Inspection. Bureau of Chemistry, U. S. Dept of Agr.



WASH SINK EQUIPPED FOR GROWING BACILLUS BULGARICUS CULTURE

Preparing Skim Milk for the Culture

Care must be exercised in the selection of skim milk for the propogation of the first mother culture. If the skim milk is fresh and clean and pasteurized twice at a temperature of 185° F. for thirty minutes, allowing between pasteurizations an interval of six to ten hours, during which the milk is held at 90° F., a good milk for the culture is insured. With ordinary creamery milk, which often has an acidity approaching .2 percent, or is not clean, it is advisable to pasteurize the milk three times at intervals of six hours before inoculating the first culture.

The pasteurization may be made either in quart bottles or in the starter can. If in bottles, they should be thoroly scalded with boiling water before the milk from the starter can is placed in them. (Quart bottles should be filled only three-fourths full.) Begin to count time of pasteurization when the milk reaches the temperature of 185° F. When pasteurizing milk in quart bottles set in a vat of water, it requires from twenty-five to thirty minutes to heat the milk to 185° F. after the water surrounding the bottles attains a temperature of 190° F. A can of milk set in water at 190° F. requires from fifteen to twenty minutes to bring the milk temperature to 185° F.

Creamery skim milk thoroly pasteurized and containing less than .2 percent acidity furnishes milk of a satisfactory quality for all propogations except the first one. However, if there is any doubt as to the thoroness of the pasteurization, the milk should be re-pasteurized, or, if the pasteurized milk is to be held six to ten hours before it is inoculated, the periodic pasteurizations always insure better results. Since the spore forms vegetate in a few hours, very poor milk may result from one pasteurization, and when creamery pasteurized milk is held several hours in the starter can and not cooled, a sweet curd is a common result. This is caused by organisms which are in a dormant condition when heated but vegetate and multiply rapidly after the pasteurization is finished and the temperature has not been sufficiently reduced to check their growth.

If the milk for the mother culture or bulk culture cannot be inoculated at once, it should be cooled and then warmed to a temperature between 95° and 100° F. just before the inoculation is made. The temperature for the best growth of Bulgaricus is also favorable for gas organisms and the dormant forms before mentioned, but if the Bulgaricus is given opportunity, it will predominate and produce a fine heavy-bodied culture.

Preparation of Mother Cultures

As a matter of convenience it is desirable to develop cultures in quart bottles, taking especial care to keep them pure and active; these are called "mother cultures." In order to obtain sufficient material for adding to the buttermilk, similar cultures are developed in cans and referred to as "bulk" cultures.

After the milk in the bottles is cooled to 100° F., it is inoculated with the commercial culture of Bacillus Bulgaricus, which may be obtained from any dairy bacteriological laboratory. After the addition of this culture, the temperature is maintained between 95° and 100° F. for twenty-four hours.

If the first propogation of B. Bulgaricus is made carefully, the desirable characteristics will be more evident in the first culture of that mother starter than they will be in a first transfer of the ordinary butter culture.

The Bulgaricus Bacillus grows rapidly and produces acid much faster and in larger quantities than does the common lactic acid germ. Several of the Bulgaricus propogations produce 2½ percent acid in forty-eight hours. Of 150 mother cultures grown from four primary cultures, an average acidity of 1.49 percent was produced in twenty-four hours. This production of acid is so rapid that the first culture acquires 1 percent or more of acid in twenty-four hours and the curd formed is viscous and ropy.

The second propogation is made on the day following the first inoculation. Milk from the starter can that has been pasteurized to 185° F. for thirty minutes may be used, but if pasteurized twice better results are assured. The quart bottle is thoroly scalded and the milk placed in it as on the previous day. A milk-testing pipette of 17.6-cc. capacity, dipped in boiling water before being used, serves as a very convenient instrument for inoculating the second bottle from the first. The first mother culture is shaken with a rotary motion, and the pipette of culture is removed and placed in the bottle of pasteurized milk, thus inoculating the second culture with 17 to 18 cc. from the first culture grown. This second culture is also shaken with a rotary motion and then placed in the bottle rack. This rack may be kept permanently in the sink of water, or improvised incubator, at a temperature between 95° and 100° F. The next day the second propogation is inoculated into the third mother culture just

as on the previous day the first propogation was inoculated into the second culture. The remainder of the second mother culture is then ready for use in ten to twenty gallons of milk, for the production of a bulk culture of Bulgaricus.

Preparation of Bulk Culture

In making the bulk culture, use a pint or a pint and one-half of mother culture for every ten gallons of pasteurized milk. Mix the culture thoroly thruout the milk and hold at a temperature between 95° and 100° F. for eighteen to twenty-four hours, or until it has an acidity varying from 1.2 to 1.5 percent. The body of the culture should be viscous and heavy. The average acidity produced in the bulk cultures which were used for buttermilk improvement was 1.58 percent in twenty-four hours.

The characteristic of the Bulgaricus culture is the heavy, viscous consistency of the curd which is formed. The viscosity of the culture which is necessary for buttermilk improvement is obtained when the proportion of acid approximates 1 percent. The viscosity is not increased by holding a culture and producing acid above 1.5 percent. Furthermore, if the acid exceeds this amount, a sharp acid flavor is likely to result. However, there may be trade conditions making it advisable to use a high acid bulk culture.

The cultures do not always develop alike. The rapid growing ones are most desirable, and are fully developed in eighteen hours. If the bulk culture is not to be used at once, it should be cooled to 50° F., or lower, to check further acid development. If possible, it should be placed in the refrigerator; in this way it may be kept for three days without injury, altho the acid gradually increases.

The bulk culture may be propogated in ordinary five or ten-gallon milk cans. However, after the culture is developed it should not be held for any length of time in metal containers but should be placed in earthen or enamel ware in order to avoid a metallic flavor caused by the action of the acid upon the metal.

Mixing Bulgaricus With Pasteurized Buttermilk

The amount of bulk culture which should be mixed with the pasteurized buttermilk depends upon the acidity and body of the buttermilk the trade demands, and the quality of the pasteurized

buttermilk which is to be improved. Ordinarily, by mixing from ten to fifteen gallons of bulk culture with one hundred gallons of pasteurized buttermilk a very satisfactory product is obtained. When the culture is poured into the buttermilk, it should be mixed thoroly by stirring; it is not at all necessary to churn the mixture, in fact, churning will reduce the viscosity. The acidity of this treated buttermilk will range from .65 to .85 percent.

At the University creamery the buttermilk as sold is a mixture of one gallon of culture to nine gallons of pasteurized buttermilk. The bulk culture is added to buttermilk fresh from the churn. The acidity of this buttermilk when prepared varies from .7 to .8 percent, and it does not whey off appreciably in forty-eight hours.

Cultures Made From Skim-Milk Powder

Where it is impossible to get good clean skim milk, it may be necessary to use skim-milk powder. In making the milk, use three-fourths of a pound of skim-milk powder to a gallon of pure water. Proceed with this milk the same as with ordinary skim milk, pasteurizing it at a temperature between 185° and 190° F. for thirty minutes. The cultures made from skim-milk powder have a distinct caramelized flavor; however, after the bulk culture is added to the buttermilk, this flavor is scarcely noticeable and not objectionable.